High resolution, book format.

Deconstruction

Ferdinand Berthoud FB1

Chronomètre

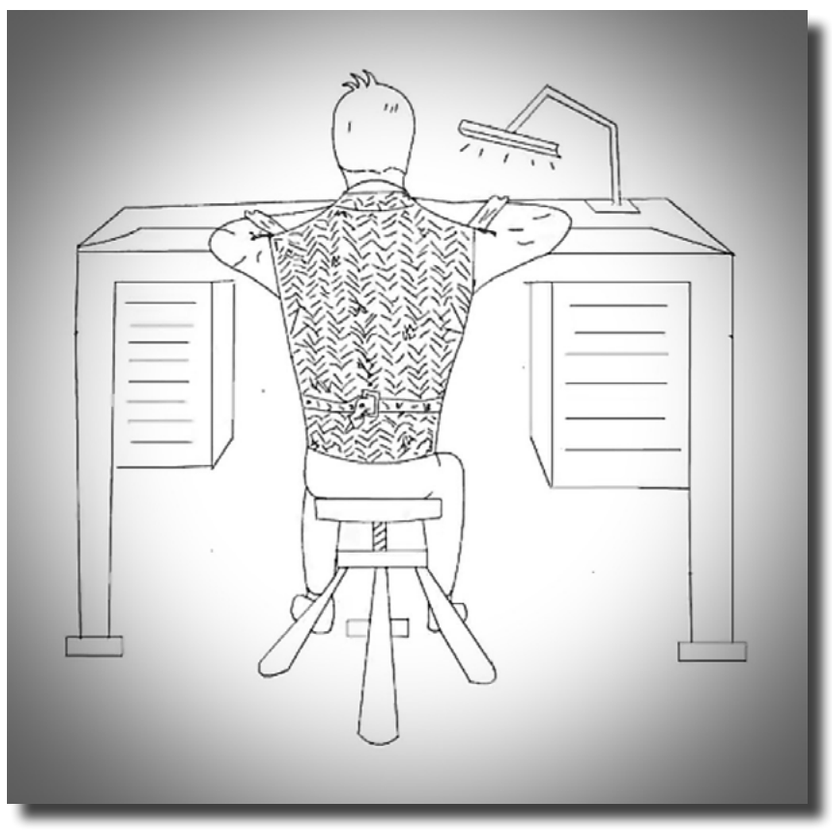
by

THE NAKED WATCHMAKER

Images from www.thenakedwatchmaker.com

Edition FB.1a

Formatted for use on mobile telephones, laptops and tablets.



Introduction

Ferdinand Berthoud was born on March 18th 1727 in Plancemont-sur-Couvet, Neuchâtel Switzerland. He died in Groslay (Val d'Oise) on June 20th 1807. He was both a scientist and a watchmaker, born into a family of horologists. At the age of fourteen, he was taken on by his brother, Jean-Henry, as a clockmaker's apprentice in Couvet. On April 16th 1745, aged 18, he moved to Paris, where he continued to improve his skills as a clockmaker.

In 1752 Ferdinand submitted to the french academy of sciences an equation clock marking leap years. On December 4th 1753, following a ruling from the King's Council in contradiction of by-laws and by special favour of the sovereign, Ferdinand Berthoud was officially granted the title of Master Watchmaker at the age of 26. In 1763, Ferdinand Berthoud was appointed by the King to examine John Harrison's H4 Marine Timekeeper in London. Harrison categorically refused to let Berthoud see the clock.

His journey opened the doors to the English scientific fraternity, thanks to the importance of his horological work and publications. On February 16th 1764 he was appointed a "foreign associate member" of the Royal Society in London.

(A short excert from the Berthoud history which can be viewed in full on the Ferdinand Berthoud website).

Note concerning deconstruction

The deconstruction of the Ferdinand Berthoud FB1 has been made using an early example from the first series, a complete kit for a new movement and a semi-complete assembled movement.

Ferdinand Berthoud

FB1 Chronomètre

The first watch in the modern Ferdinand Berthoud collection.

Functions

A 1 minute rotating tourbillon cage with central seconds hand. Off-set minute and hour indication with a 53 hour power reserve indicator positioned at 9 o'clock on the dial. Precision and rate accuracy are certified by the Swiss Official Chronometer Testing Institute.

The seconds hand is driven by a wheel of the same dimensions, to a second wheel fixed to the Tourbillon cage which turns anti-clockwise. These can be seen in the cut-out below the center of the dial and generate a significant aesthetic element of the watch. When the watch is assembled the watchmaker alines the arms/spokes of the two wheels.

Technical Specifications

The movement calibre reference is FB-T.FC. The number of jewels: 46. Octagonal white gold case with 6 sapphire windows, titanium inter-lug sections. Sapphire crystal with anti-reflective coating. Water resistance: 3 bar/30 meters. Case size: diameter: 44mm, Thickness: 12.96 mm.

The strap is held in place by spring bars into
the titanium shoulder sections.
(Below removed.)

(The satin straight grained sections for the
strap are the titanium inserts.)

The white gold knurled crown is set with an 18carat red gold insert with the brands initials engraved into it.

The polished section of the case is made in 18carat white gold.

Each watch is engraved with a unique reference associated to the limited edition.

The 2 o’clock window showing the barrel with chain. The watch is ‘unwound’.

The 4 o’clock window showing the side of the movement and part of the setting mechanism.

The 8 o’clock window showing part of the power reserve mechanism.

The 10 o’clock window showing the fusee with a single row of chain. The watch is ‘unwound’.

The 4 titanium ‘square’ screw heads, positioned next to the side windows, link to the material and matt finish of the titanium shoulders inserts they hold in place.

The square screw heads and the side windows reduce optically, the overall height of the watch and allow the lateral ellements of the calibre to be viewed.

The overall design of the case marries together a combination of the strength of the octagonal form often used by the designer Gerald Genta during his lifetime, combined with strong antiquarian horological influences.

The large tourbillon cage with free-sprung balance spring, fusee, fine armed wheels, hand finishing and stop work, are all elements that are associated to early watchmaking.

The case back has 5 facets machined into its circumference which allows it to be screwed on the centre, either using a 3 piece case back key or a tailor-made 5 piece tool.

The rubber seal rendering the case back water resistant is set into the gold centre section and lubricated with a specialised silicon grease.

Calibre FB-T.TC

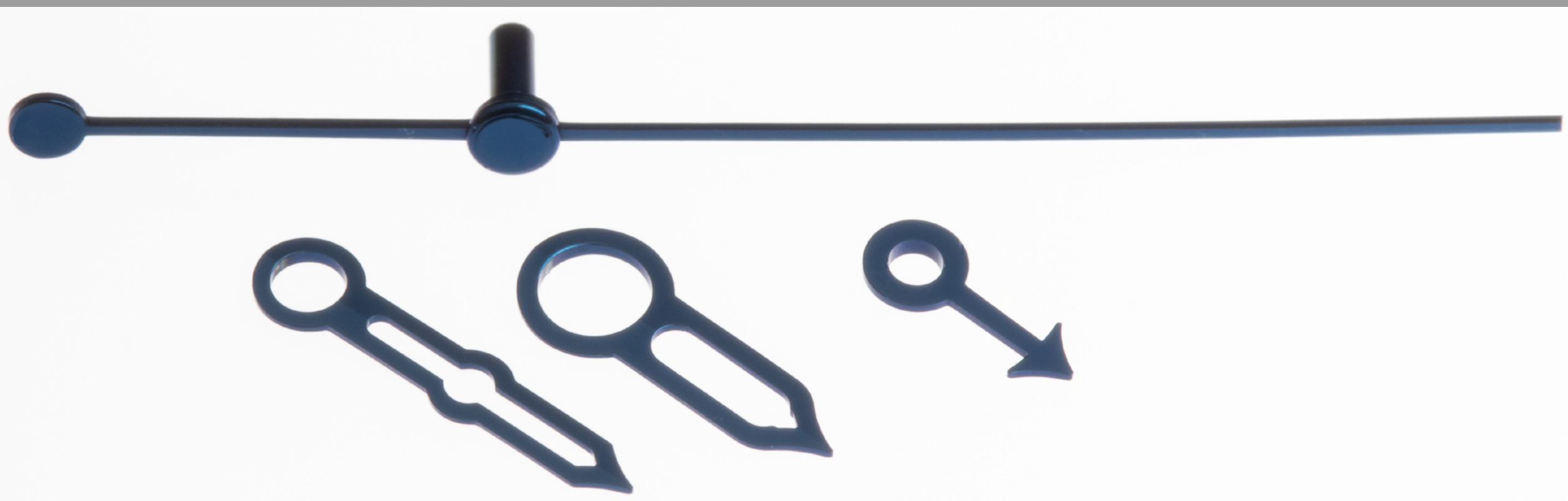
15 ¾ lignes (diameter 35.50 mm – thickness 7.96 mm)

The green coloured bridges are made from ‘maillechort’ (German silver), decorated and left un-plated. The circular graining when finished is delicate, the smallest imperfections can be seen contrasted against the finished surfaces.

The steel plates held in place onto the barrel by 4 screws, with the limited edition number, mechanically engraved and hand lacquered.

The dial is made from an assembly of 6 components riveted together. The internal angling is executed by hand as is the straight-graining of the central dial segment, and final assembly. The ‘Haut-Bas’ and Ferdinand Berthoud are engraved into the dial, before being lacquered.

The hour, minute and power reserve hands are made from 18-carat gold. The second's hand 0.22mm thick and 24.68mm long made from bronze. Once decorated, they are treated in a blue PVD treatment.



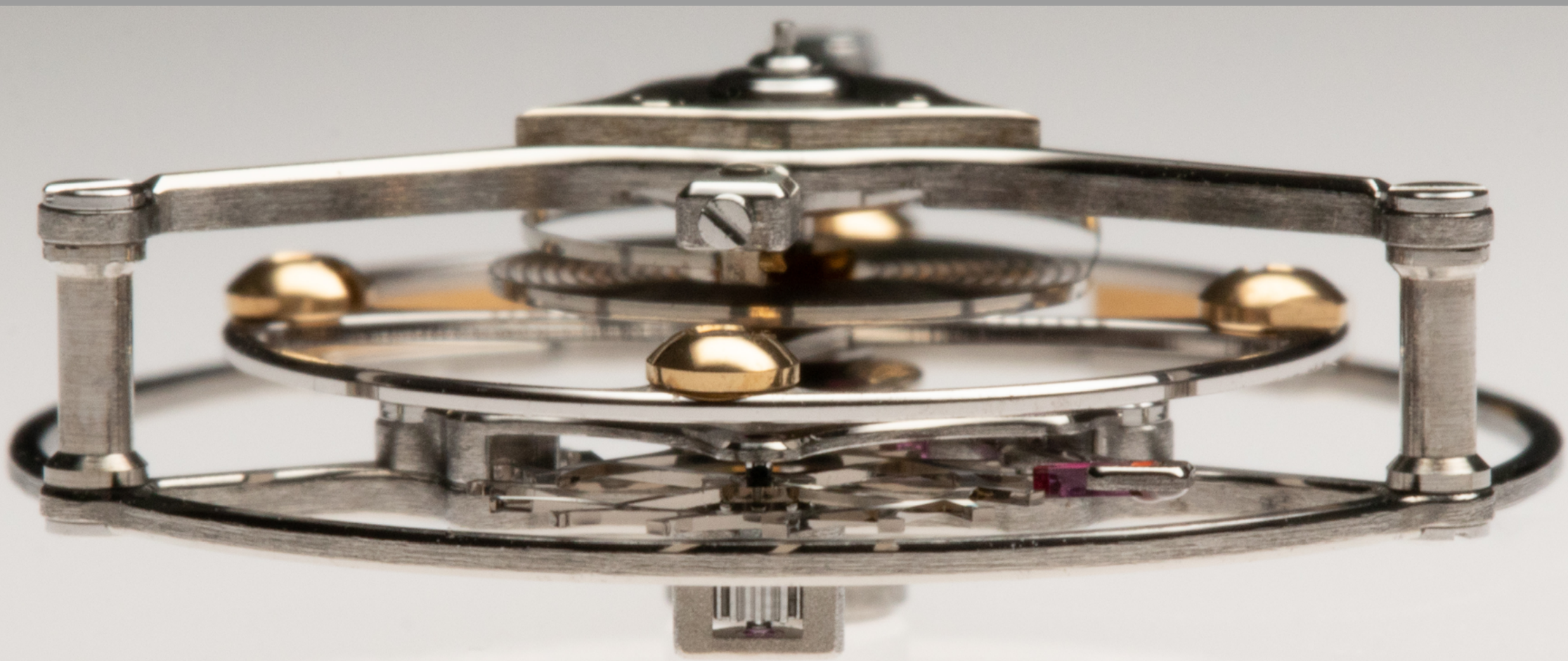
The full length of the seconds hand is bombé (rounded) manually.

Many of the following individual components are taken from a movement kit yet to be assembled. As such many individual assemblies of parts have not yet been made but the part itself has been decorated. Below is the bridge that holds in place the Tourbillon cage. Before this can be added to the movement the jewel the cage pivots in will be pushed into a gold ring, that will then be pushed into this bridge.

The Tourbillon cage

The cage is poised by the two 18-carat gold weights fixed to the opposite side to the escapement. Shown at the back of this image.

The four gold coloured timing weights are to adjust the time keeping. All four have slots cut into them and two have a flat machined on one side, that are sitting opposite each other. By turning these weights and moving their mass further from the centre of rotation or closer to it causes the balance to rotate slower or faster adjusting the timing.



The complete cage comprises of 67 components.

An exploded view of the cage.

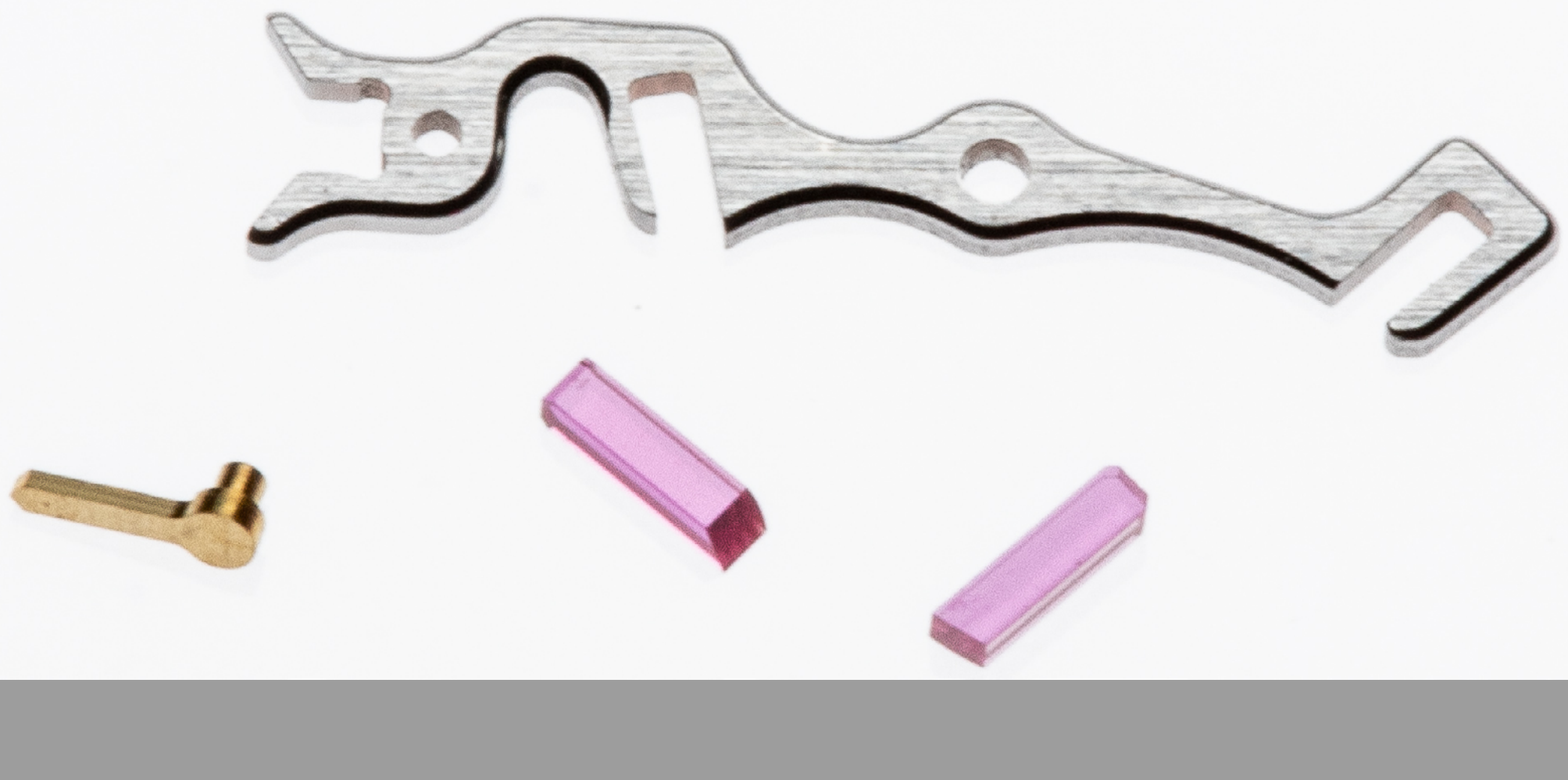
The wheels at the bottom of the drawing drive the cage,
and seconds hand, are those that can be seen through the dial.

The Tourbillon cage is oversized compared to the majority of modern watch calibres. The size is the result of the large 35.5mm diameter calibre, which in turn influences the 44mm case and the absence or need of a movement ring between case and calibre.

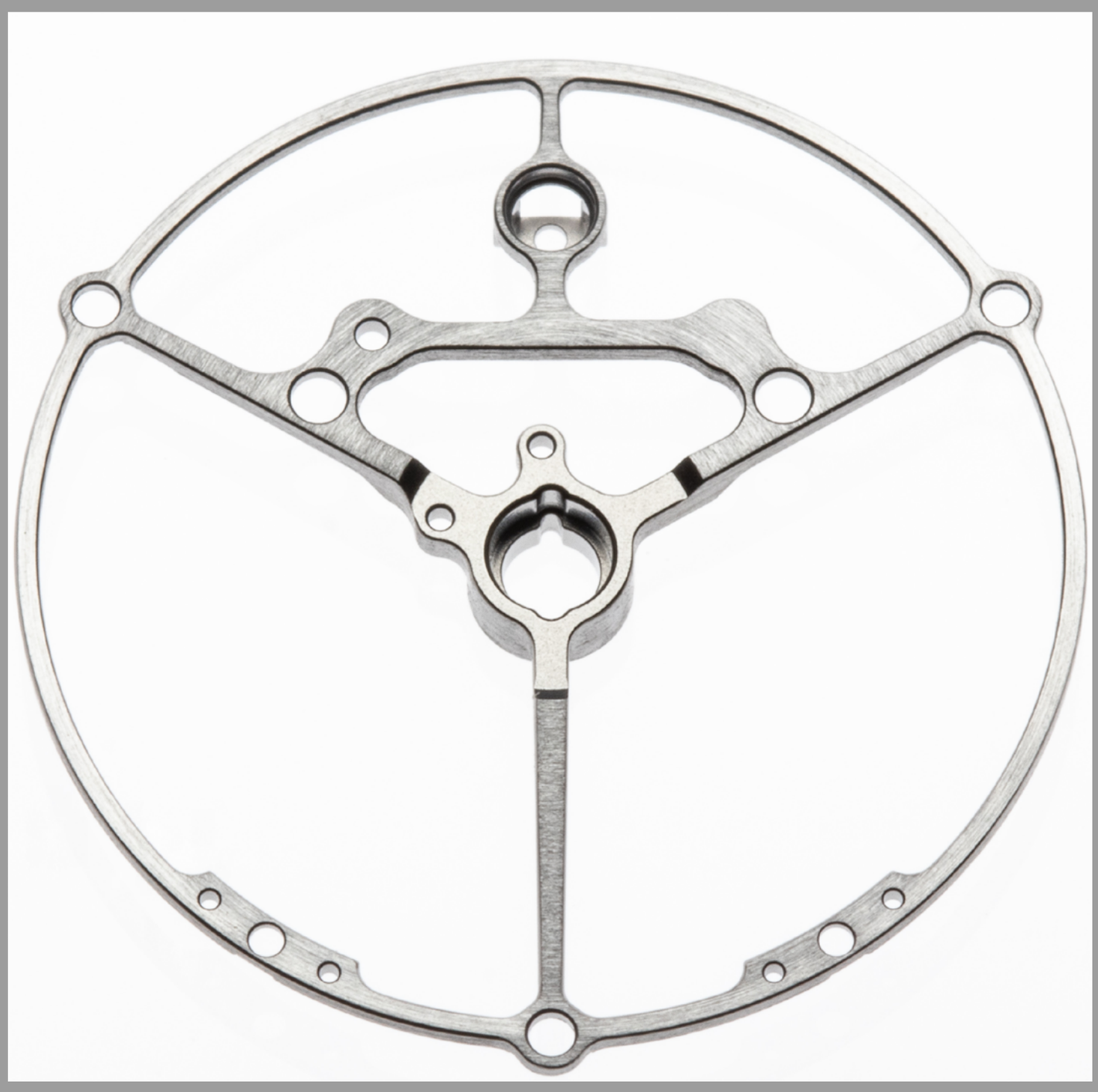
Below, some of the parts that make up the Tourbillon cage. Shown prior to assembly (sub-assembly) of the individual component. The exception is the fully mounted balance wheel.

The cage, as with the complete movement is assembled by hand once the pieces have been decorated. The movement requires approximately 40 hours to be assembled.

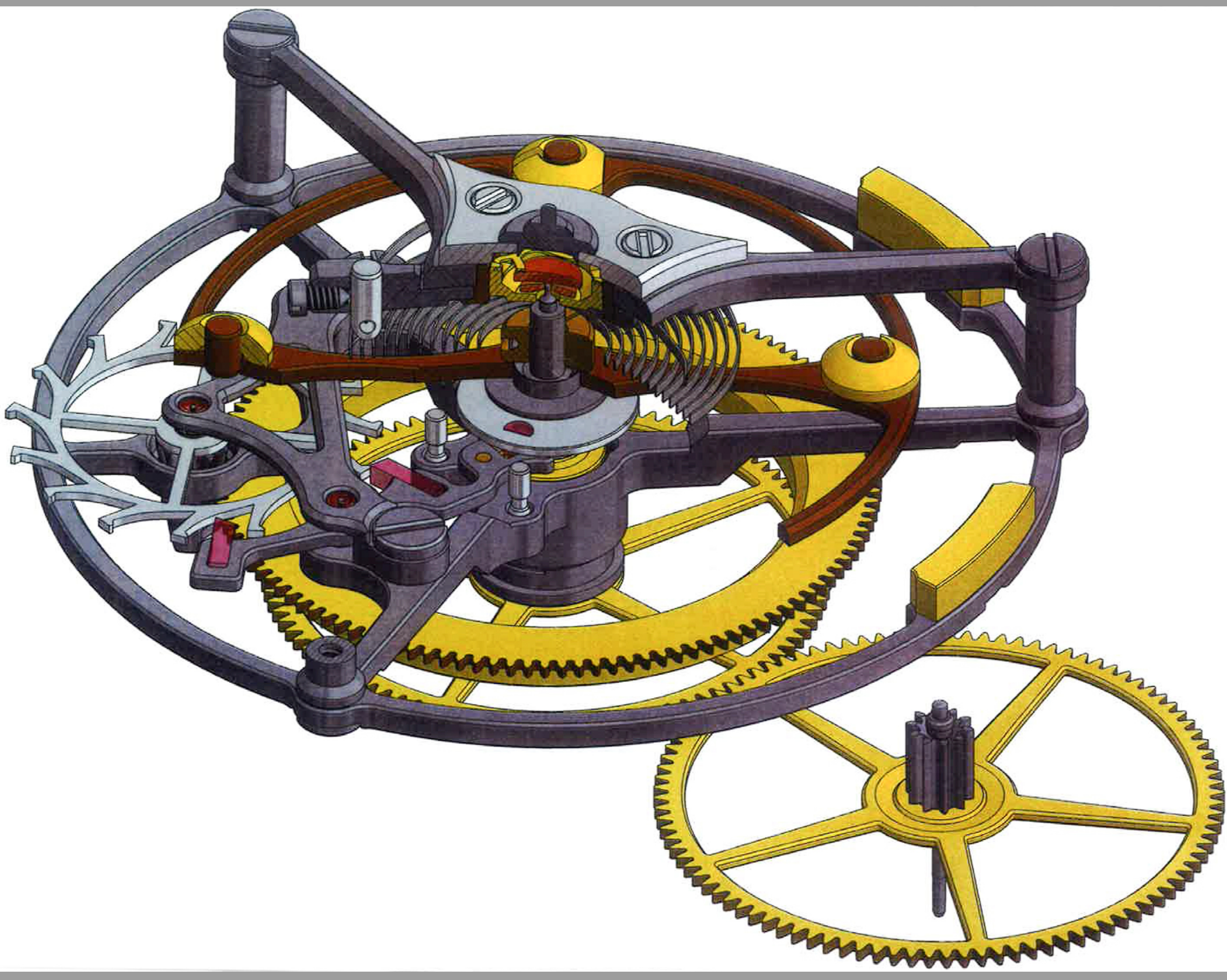
The Swiss lever prior to assembly.



The titanium cage bridges. Although light and strong, a practical material for a cage, the component angling is hard to polish and takes considerably longer than with conventional carbon steel architecture.

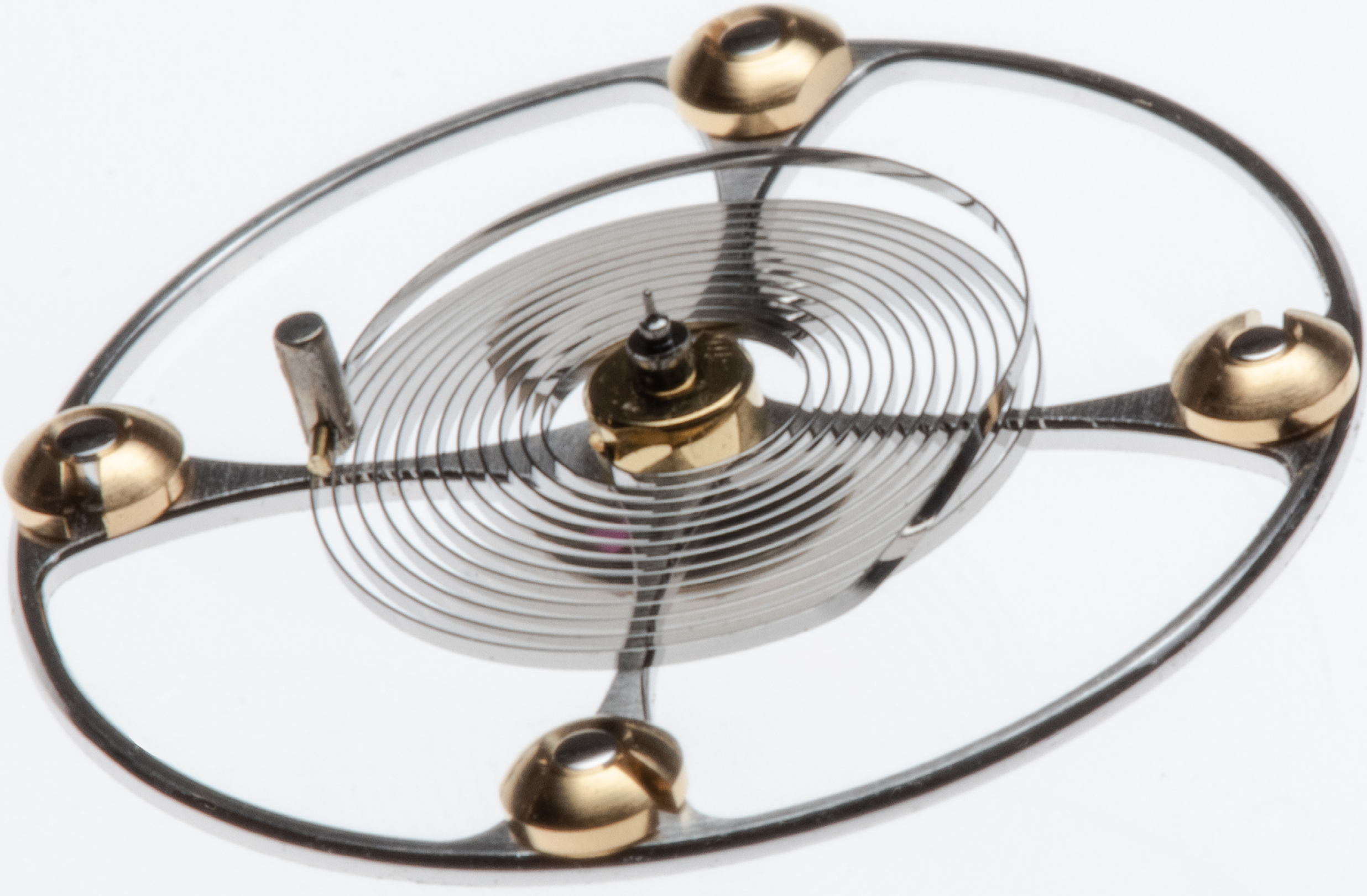


A cut away of the cage showing the Swiss lever connecting with the semi-circular impulse jewel.



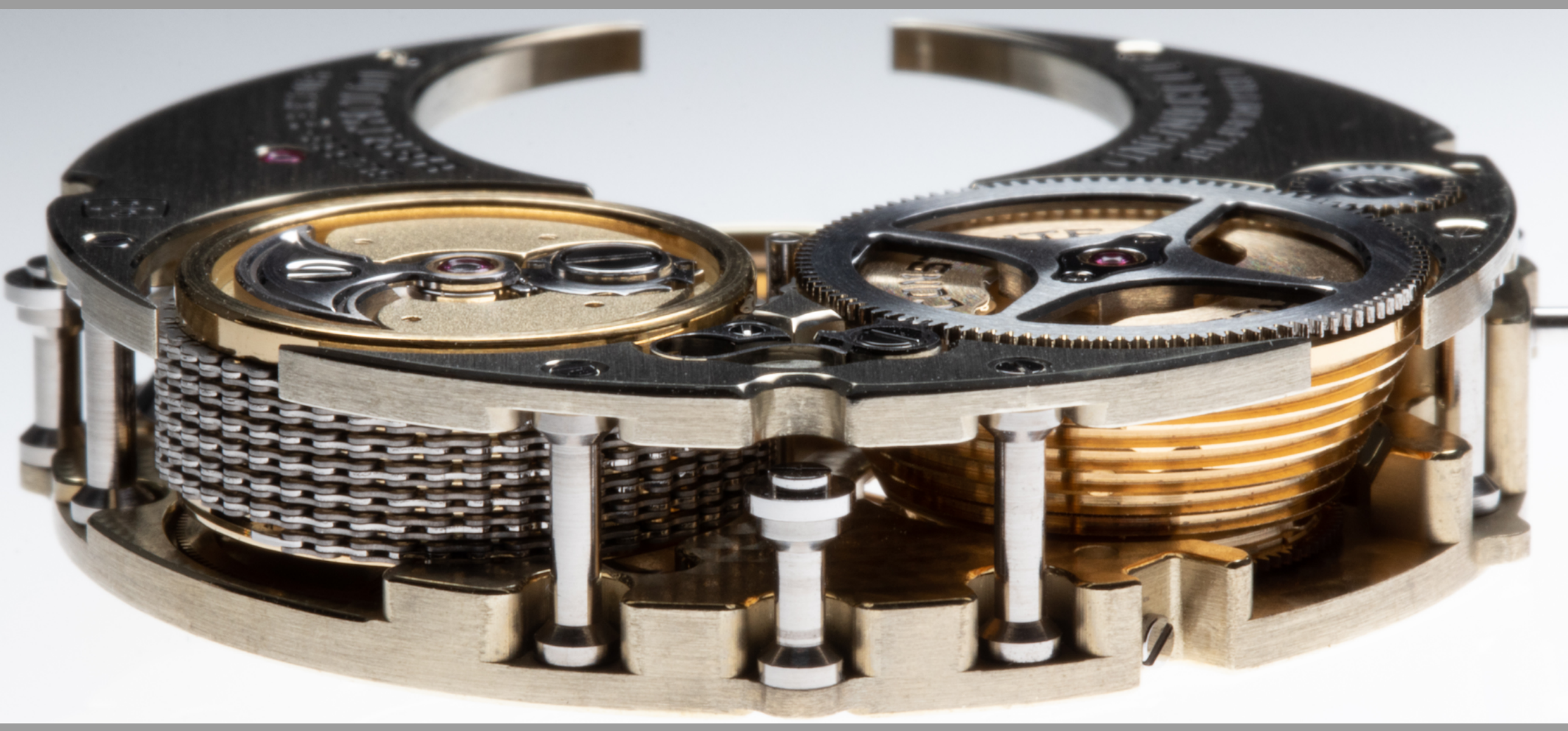
The lower two wheels are those viewed through the dial.

The balance vibrates at a frequency of 3Hz, (21600Vph). The balance wheel is made from CuBe (beryllium bronze) decorated, and rhodium plated. The 4 circular timing weights are made from German silver (maillechort) decorated and plated with 5n red gold.



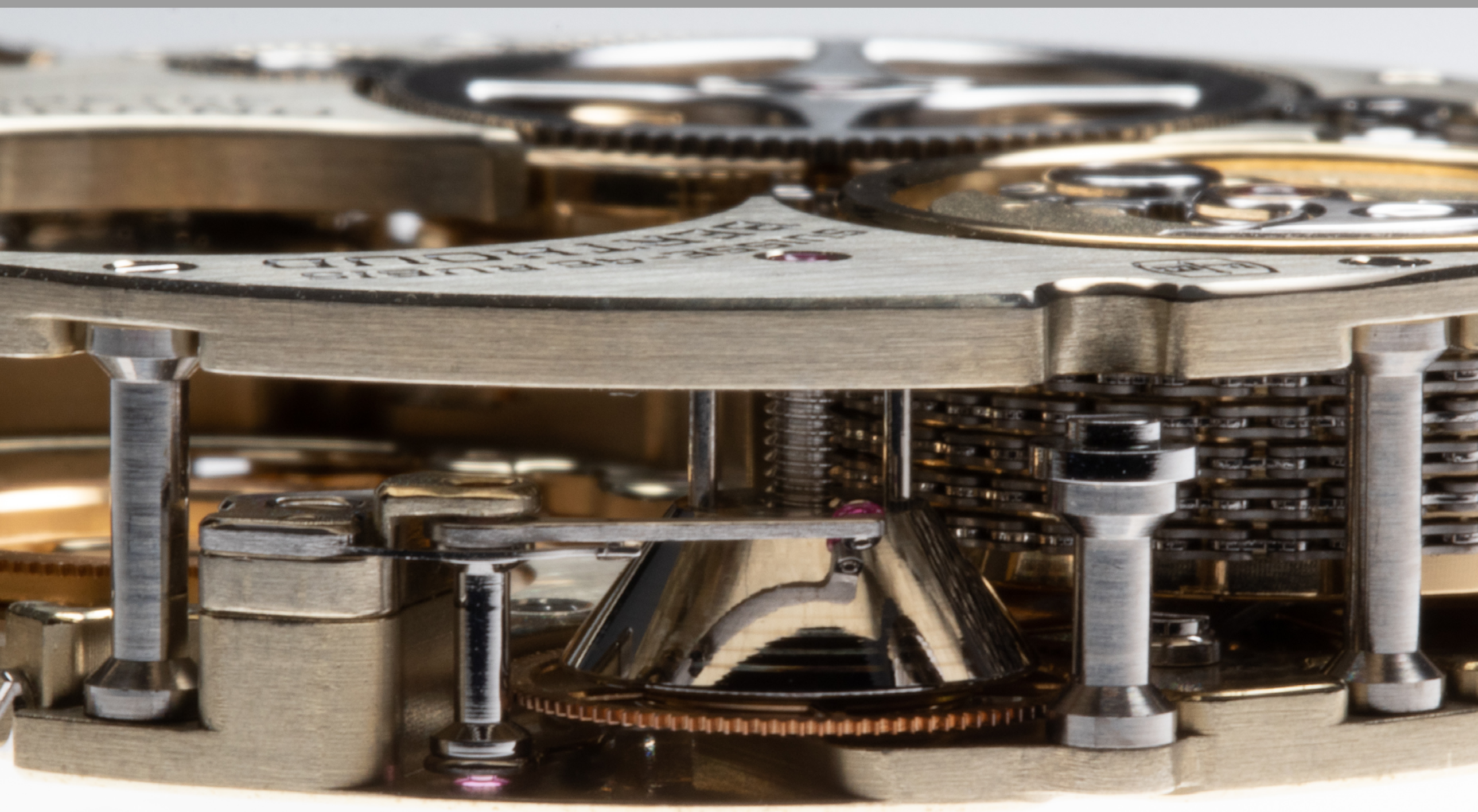
The upper bridge holding the cage in place, and the tourbillon cage have been removed. Below the cage, set concentrically into the main plate is a large wheel. This ‘fixed wheel’ remains static and powers the escape wheel pinion, which rotates around it driven by the wheel viewed under the cut out below the fixed wheel. This lower wheel which drives the tourbillon cage pivots on the large jewel in the centre of the fixed wheel.

(To the left is the barrel assembly, to the right the fusee.)



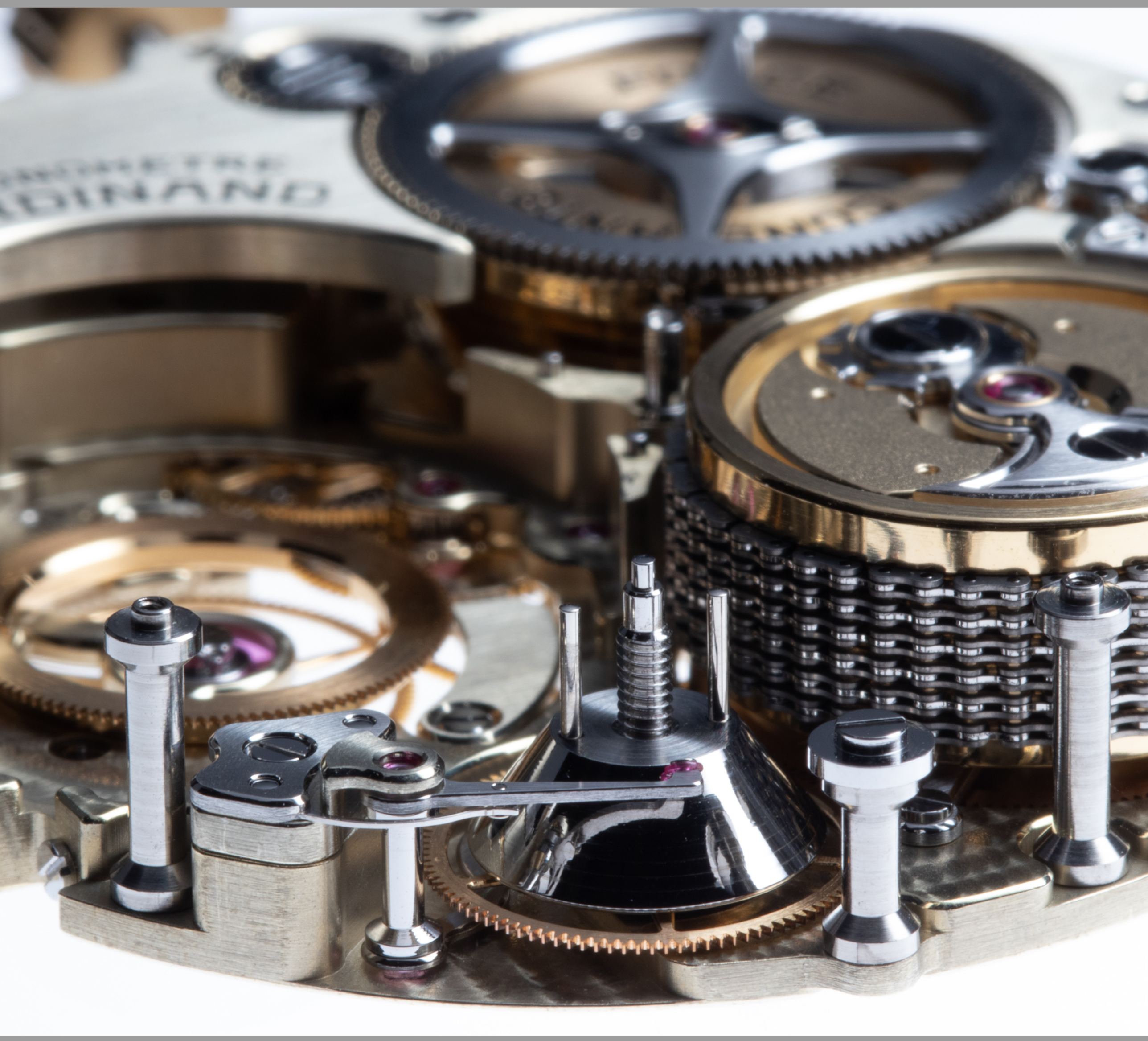
The main-plate and upper bridge are connected through pillars. Pillars are traditional in early pocket watch movements but rarely seen in modern calibres. This design feature facilitates the ability to see the movement through the case-side windows. It associates to the origins of the brand, i.e. antiquarian horology. It is neither negative or positive in relation to the assembly or function of the watch. It does require more components and time to produce and assemble.

The polished cone travels vertically upon its central threaded post as the watch is wound and unwinds. A jewelled tipped lever sits in a fixed lateral position on the outside of the centre of the cone. As the cone moves up and down, the lever moves in and out linked though a series of gears illustrating the power reserve level, though a hand on the dial.



The bridge to the right of the cage removed.

The power reserve indication system. The cone travels up the threaded central core, the two polished steel posts either side of it are there to prevent the cone from turning, and stabilise the cone as it travels vertically.



Recto-verso of the bridge which supports the click system for the ratchet wheel, situated between the fusee and barrel at the top of the movement.

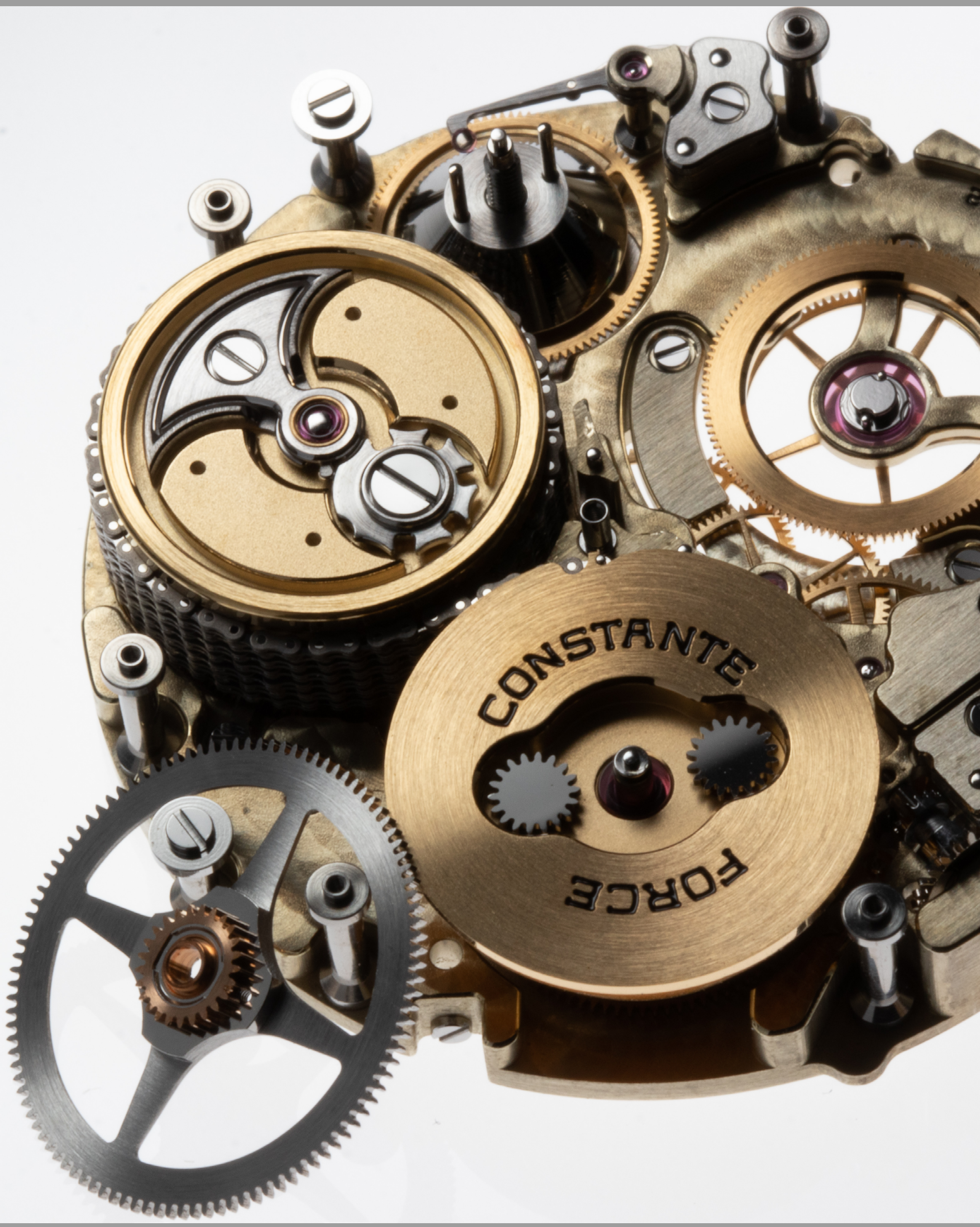
Manually decorated with polished angling and straight-grained surface and sides.

The rear of the bridge is spotted (or with ‘Pearlage’).

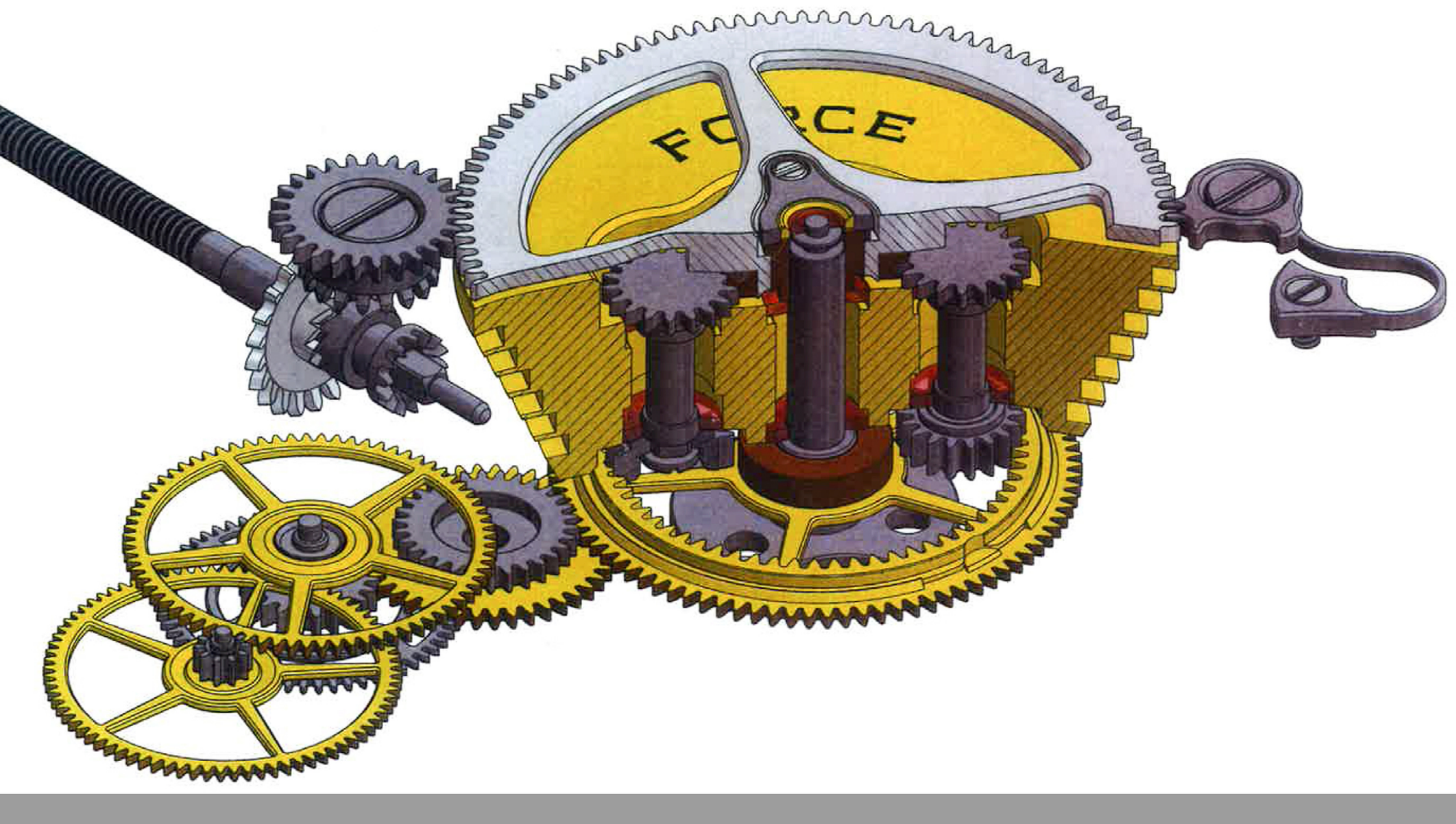
The three principle bridges removed from the watch. Both the barrel and fusee sit on steel posts and are held in place independently of the bridges.

Manually decorated with polished angling, straight grained surfaces / sides and spotted (Pearlage) underside. The written details are machine engraved and then hand lacquered for contrast. The lacquer itself resists the chemical solutions used when cleaning them.

The steel ratchet wheel (shown to the side), that winds the fusee by pulling the chain, removed.



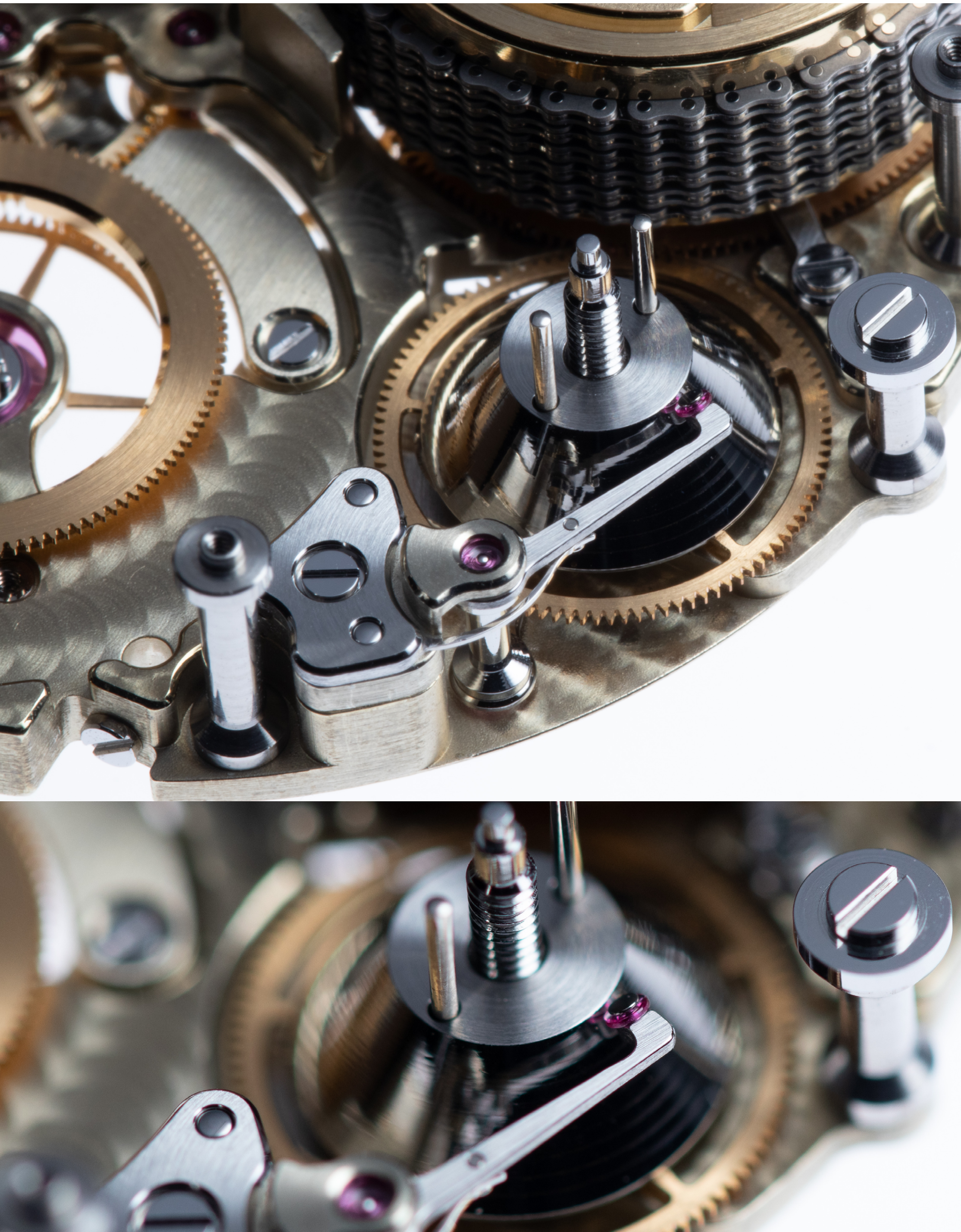
The watch is wound manually as with early pocket watch movements. The ratchet wheel turns, winding up the fusee by rotating two steel pinions in its centre. These then turn the fusee winding the barrel and its mainspring. The power from the mainspring is then driven through the fusee turning the wheel below it, which drives the train leading to the Tourbillon.



The recto-verso of the hardened steel ratchet wheel prior to assembly.

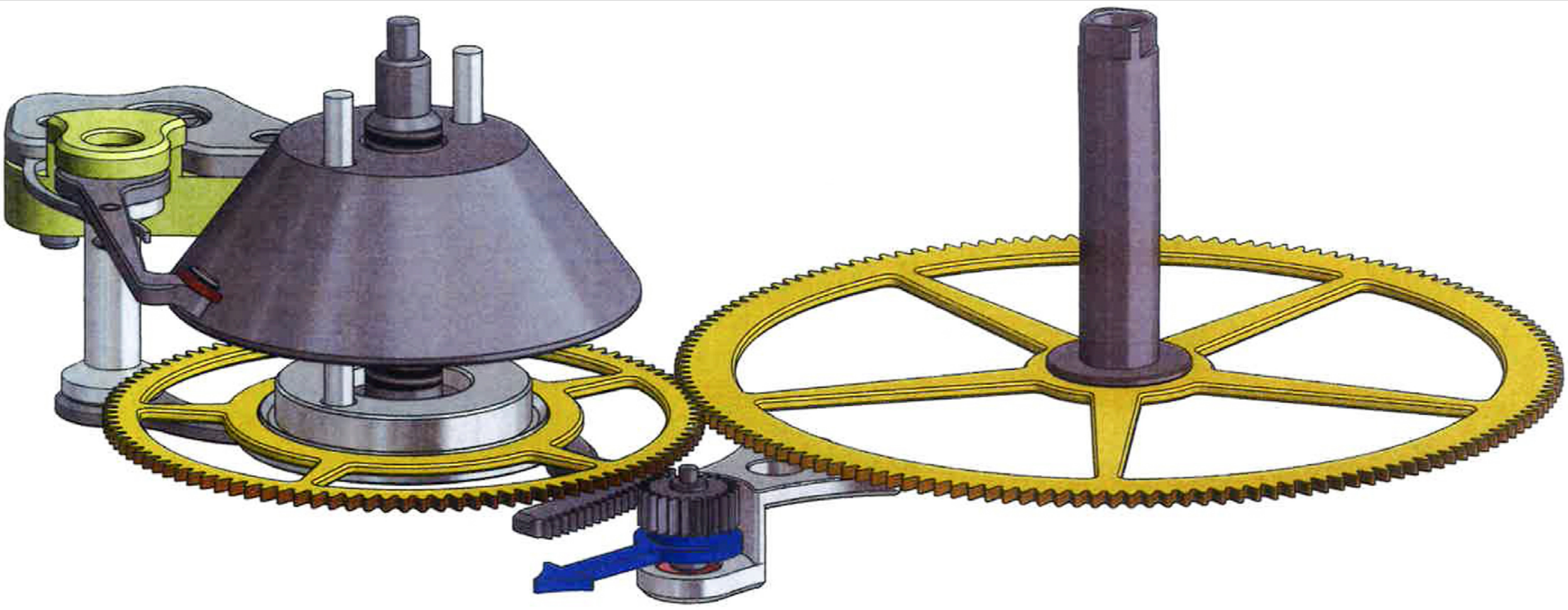
The Power Reserve System

Below are 2 images showing the power reserve cone, the second focus's specifically on the jewelled tip of the operating lever.



As the barrel winds up and down (sitting on the right hand post) the assembly to the left with cone turns causing the cone to travel vertically.

The jewelled tipped lever moves in and out causing the rack and pinion system linked to it, (shown under the cone) to turn, indicating the power reserve.



Some of the steel components that make up the power reserve system, prior to being assembled.

When the chain is fully wound around the cone, the barrel is fully charged.

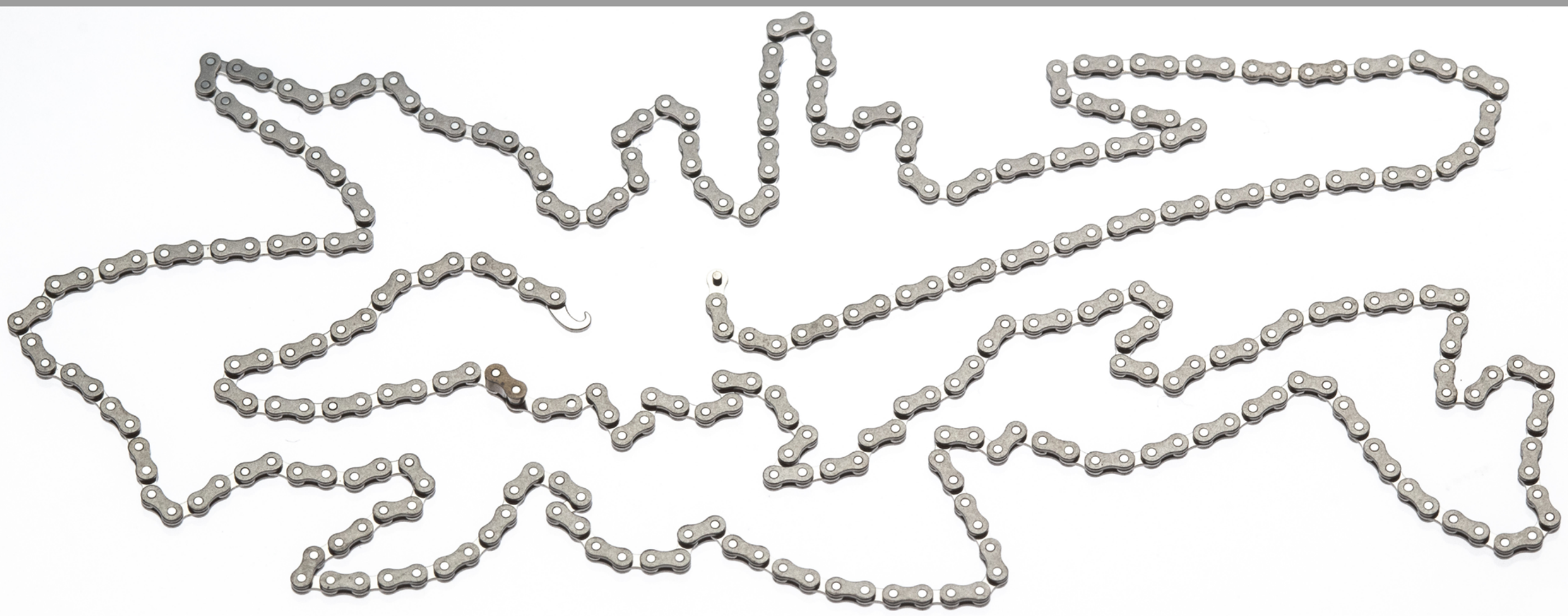
The system above is the stop-work. It limits the number of turns of the barrel to 6. Never allowing the barrel to fully be wound, or fully unwind. The result is using only the most even section of the main-spring.

The barrel and fusee prior to being assembled. The angle of the cone of the fusee, correlates to the change in force of the mainspring, to produce a constant force transmission to the escapement, through the gear train.

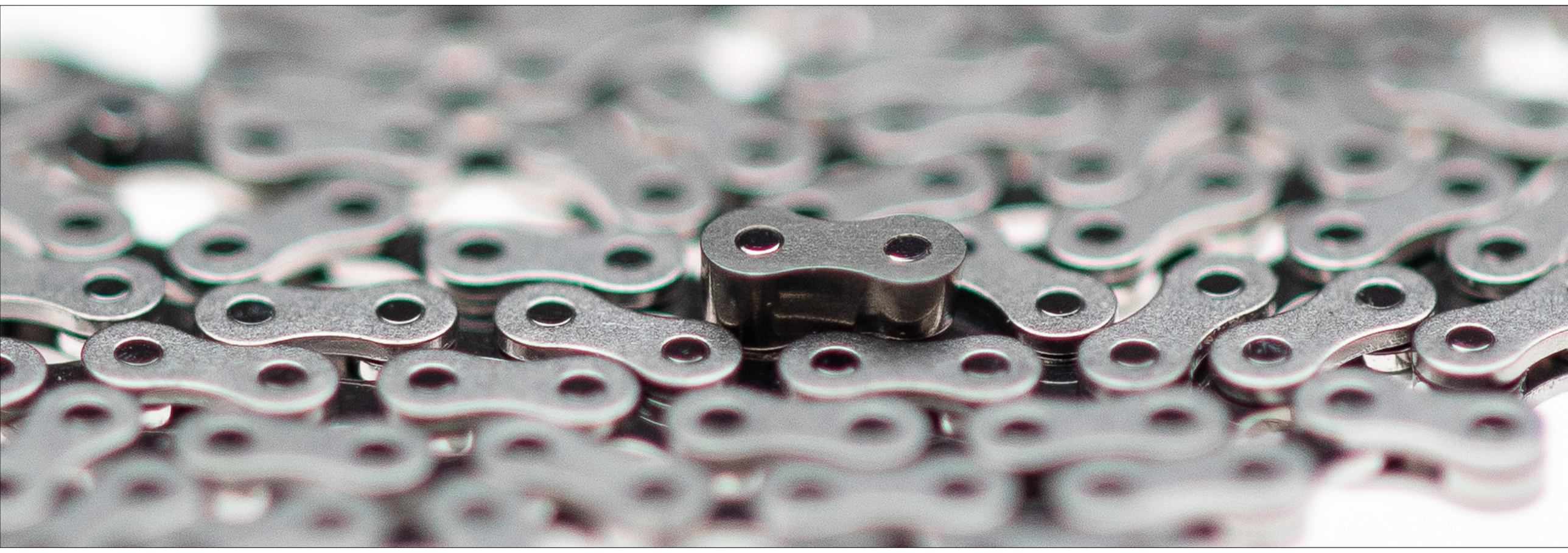
A cut-out illustration indicating the barrel, and the meshing of the wheel that drives the power reserve cone.

The Fusee Chain

There fusee chain which is manually assembled. It measure 28cm in length and resists a tension of 3kg. It is also assembled manually by the watchmaker building the watch.



The single double thickness link acts as a security in addition to the stop work for the mainspring, assuring the barrel will only be wound during the most regular power transmission section of the spring.



The principle components in the setting mechanism.

Recto-verso of the main-plate after decoration,
and prior to assembly.

Summary

The final watch combines modern materials, design and manufacturing techniques with antiquarian features. This can be seen by the use of maillechort, a fusee, large balance wheel, Tourbillon, pillars and cone driven power reserve. The repeated use of polished internal angles and hand decoration can be seen throughout the movement.


HAUT
BAS
1/2
3/4
1/4
0
FERDINAND
BERTHOUD
CHRONOMETRE
VAL-DE-TRAVERS SUISSE

www.thenakedwatchmaker.com